WHAT IS CLAIMED IS

1   1.   A complex single sideband zero IF down-converter frequency demodulator or

2   frequency discriminator/comparator, comprising:

3   means for receiving and splitting a local oscillator (LO) signal of frequency ω_0 to two

4   components: the in-phase component and the quadrature component;

5   means for receiving and splitting an input signal of carrier frequency ω_c to two

6   components: the in-phase component and the quadrature component;

7   means for multiplying each one of the said in-phase and quadrature LO signal

8   components with each one of the said in-phase and quadrature input signal

9   components, for generating a total of four different converted input signals;

10   means for combining (adding or subtracting) in two pairs the said four converted

11   signals, producing two lower single sideband signals: the in-phase signal

12    $I^-(t)$ and the quadrature signal $Q^-(t)$;

13   means for delaying each of the said in-phase $I^-(t)$ and quadrature $Q^-(t)$ signals by

14   substantially same time delay τ, providing respective delayed baseband

15   signals $I^-(t-\tau)$ and $Q^-(t-\tau)$;

16   means for multiplying the said delayed signals with the said un-delayed signals, to

17   generate two multiplication products $I^-(t-\tau)Q^-(t)$ and $I^-(t)Q^-(t-\tau)$;

18   means for combining (subtracting) the said two multiplication products, providing the

19   demodulated baseband signal $BB(t)$;

20   means for outputting the said demodulated baseband signal;

21   means for generating a local oscillator signal of frequency ω_0, which is related to

22   frequency ω_c and time delay τ by equation $(\omega_c - \omega_0)\tau \cong n\pi$, where

23    $n = 0,\pm1,\pm,2,....$.

1   2.   The frequency demodulator of Claim 1, wherein the input signal is frequency

2   modulated by transmitted information, having the average frequency equal to ω_c and the

3   instantaneous frequency deviation proportional to the transmitted information.

1   3   The frequency discriminator/comparator of Claim 1, wherein the input signal

2   is a signal derived from a signal source having a dominant frequency ω_c, which is being

3   compared with the LO frequency ω_0.

1   4.   The frequency demodulator or discriminator/comparator of Claim 1, wherein

2   the multiplication operation is replaced with exclusive OR (XOR) logic function, and related

3   signals are bi-level (digital) signals.

1   5.   The frequency demodulator or discriminator/comparator of Claim 1, wherein

2   the input signal and/or the LO signal is first scaled in frequency by division with an integer

3   number in a frequency divider.

1   6.   A complex single sideband zero IF down-converter frequency

2   discriminator/comparator, comprising:

3   means for receiving and splitting a local oscillator (LO) signal of frequency ω_0 to two

4   components: the in-phase component and the quadrature component;

5   means for receiving and splitting an input signal having a dominant frequency ω_c to

6   two components: the in-phase component and the quadrature component;

7   means for multiplying each one of the said in-phase and quadrature LO signal

8   components with each one of the said in-phase and quadrature input signal

9   components, for generating a total of four different converted input signals;

10   means for combining (adding or subtracting) in two pairs the said four converted

11   signals, producing two lower single sideband signals: the in-phase signal

12          $I^-(t)$ and the quadrature signal $Q^-(t)$;

13   means for delaying only one of the two said signals by time delay τ, providing one

14   delayed base band signal, $I^-(t-\tau)$ or $Q^-(t-\tau)$;

15   means for multiplying the said delayed signal with one of the said un-delayed signals,

16   to generate one multiplication product, $I^-(t-\tau)Q^-(t)$ or $I^-(t)Q^-(t-\tau)$,

17   providing the baseband signal $BB(t)$;

18   means for outputting the said demodulated baseband signal;

19   means for generating a local oscillator signal of frequency ω_0, which is substantially

20   equal to frequency ω_c.

1   7.   The frequency discriminator/comparator of Claim 6, wherein the

2   multiplication operation is replaced with exclusive OR (XOR) logic function, and related

3   signals are bi-level (digital) signals.

1   8.   The frequency discriminator/comparator of Claim 6, wherein the input signal

2   and/or the LO signal is first scaled in frequency by division with an integer number in a

3   frequency divider.

1   9.   The frequency discriminator/comparator of Claim 1, wherein the said

2   frequency discriminator (FD) is switched to a phase detector (PD).

1   10.   The frequency discriminator/comparator of Claim 6, wherein the said FD is

2   switched to a PD.